

The Role of JSTARS in Combat Identification

**A Monograph
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ABSTRACT

THE ROLE OF JSTARS IN COMBAT IDENTIFICATION

By Major Jody L. Blanchfield, USAF, 59 pages.

Fratricide remains one of the most challenging problems of the modern battlespace. Fratricide incidents have occurred in every major conflict in history and continue to increase. The fratricide fatality rate was significantly high during Desert Storm in 1991, the most recent major conflict involving offensive joint air and ground forces. Despite specific attention to this problem during a short war in which joint forces had an overwhelming combat advantage, the fratricide rate was an alarming 24%. Consequently, fratricide has remained a priority issue for the military throughout this decade.

This monograph suggests that current efforts to minimize fratricide have focused too exclusively on technological solutions. There is a severe lack of integration and synchronization efforts within this technology explosion, particularly for the surface-to-surface and air-to-surface mission areas. Since there are diverse technologies within the independent services that must operate jointly in the battlespace, a systemic approach is critical.

After an examination of the joint air identification system, the monograph concludes that it is successful because it is an integrated network of air and ground elements that each contribute to a synergistic product, a single integrated air picture. AWACS, as a centralized battle management radar platform, performs a unique role in this network. This monograph demonstrates that JSTARS is capable of performing a similar role for the surface environment. JSTARS has the capability to develop and disseminate common pictures, at both tactical and operational levels. JSTARS can figure prominently in support of attack operations. JSTARS is a critical fusion platform that begins the melding process of the separate surface and air pictures into a common joint awareness.

This study concludes that a systemic approach must be utilized to reduce fratricide within the surface-to-surface and air-to-surface mission areas. Current technologies must be integrated into a networked system across the joint battlespace, leveraging battle management platforms such as JSTARS. Exploiting these capabilities is critical to increasing situational awareness, improving target location accuracy, and promoting higher confidence during the engagement decision cycle. Such factors have been directly attributed to reducing fratricide.

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I. Introduction

America has emerged as the single superpower in the world today. Along with this distinction, the U.S. has arguably the best, most modern and most capable armed force protecting and preserving national interests. The U.S. is a technological leader in modern warfare, possessing many of the most advanced weapons systems in the world. Dominance of the U.S. military during conflict has resulted in a general reduction of battle casualties among U.S. forces.¹ However, the problem of fratricide still remains a serious concern. Fratricide is defined by joint doctrine as the unintentional killing or wounding of friendly personnel by friendly fire.² Fratricide often results in tragic loss of life that profoundly affects those involved, even influencing the conduct of operations. In perhaps the most famous fratricide incident of U.S. military history, one of the most renowned Civil War generals, Thomas "Stonewall" Jackson, was killed by the fire of his own troops at Chancellorsville in May 1863. The loss of the "strong right arm" of Confederate commander-in-chief Robert E. Lee demoralized the entire Confederacy, and still fuels speculation about the course of American history had Jackson been there to fight with Lee at Gettysburg.³ While fratricide that influences the entire outcome of a conflict is indeed rare, cases of modern fratricide have greatly influenced important areas of current warfare, such as operational procedures and technological developments.

Fratricide remains a priority concern among the military for several reasons. The emphasis on joint operations, the increased lethality of combat systems, the fielding of weapon and sensor systems capable of engaging beyond visual range, and the faster pace of battle encompassing night and adverse weather conditions, are all factors in modern warfare that contribute to the complexity of the battlespace. Fratricide becomes more

likely as the battlespace becomes more complex. Fratricide incidents have indeed increased in over the last few decades.⁴ Minimizing the incidence of fratricide within an increasingly complex joint battlespace is one of the more difficult problems facing commanders today. The fratricide fatality rate was 24% during the Persian Gulf War in 1991, the most recent major conflict involving offensive joint air and ground forces.⁵

While loss of life in itself has always been a significant problem for the military, the issue of fratricide is increasingly sensitive due to an emerging social and political mentality of "casualty aversion." America has become a country preoccupied with bloodless war, as the cultural perception of war has been greatly influenced by intense media coverage on military conflicts during the past decade.⁶ This new concept of conflict is based on low collateral damage as precision munitions score direct hits on specific military targets, resulting in minimal combat casualties, both to combatants and non-combatants. Given this idea of minimal combat casualties, self-inflicted casualties become even more horrific and politically unacceptable.

The limited research on fratricide indicates a few major factors that consistently influence fratricide, including target identification, poor or incorrect target information, and loss of situational awareness by combat participants.⁷ Fratricide is a combat area that is very difficult to analyze, due to the sensitivity of the subject and the problems of constructing accurately a given combat situation after the fact. LTC Charles Shrader was among the first to offer an historical compilation of modern fratricide incidents in 1982 in Amicide: The Problem of Friendly Fire in Modern War. Schrader cited the lack of thorough, systematic studies in either official or unofficial literature, and reasoned that the conditions of active combat preclude accurate, complete reporting on what may, at the

time, seem relatively minor incidents given the scale of conflict.⁸ Schrader also recognized that the commanders and personnel of units responsible for friendly fire are not usually in a position to evaluate their actions. They may hesitate to report incidences for a variety of reasons: damaging unit or personal reputation, fear of legal reprisal, concern for troop morale, or concern for survivors. Historically, most incidences of fratricide that became public were usually the result of formal investigations or reports. In today's complex combat environment, where the media is often able to receive and disseminate combat information quickly to the general public, fratricide can be a devastating component in information warfare.

Efforts to minimize fratricide have focused primarily on improvements in operational procedures and technological solutions, specifically under a formal concept called Combat Identification (CID). CID is defined as a process that results in a "shooter" determining a target's identification in support of an engagement decision under specified rules of engagement.⁹ CID is divided into four specific mission areas: surface-to-surface, air-to-air, surface-to-air, and air-to-surface. These last two mission areas, where the combat power of two distinctly different operating environments merge, present particularly complex problems. Two uniquely different service components also usually come together at this seam in the battlespace, the Army and the Air Force. Joint operational procedures must be effective, timely, and standardized between the different services, and their diverse combat technologies must be integrated in order to reduce fratricide in these critical mission areas.

Efforts to reduce fratricide in the surface-to-air mission area have developed rather quickly and effectively. Technological solutions and operational procedures are in

place for effective identification of air elements, which afforded parallel efforts for the surface-to-air and air-to-air mission areas. Surface unit "shooters" that engaged air targets were included in the developmental identification efforts, both technologically and procedurally.

However, developing effective measures in the surface-to-surface and air-to-surface areas has been much slower and difficult. This is due to the complex nature of the ground environment itself: it is more populated, diverse, and variable than the air environment. Identification efforts for ground elements need to include the air units that engage ground targets in order for the air-to-surface mission area to be addressed effectively.

Combat Identification needs to encompass the entire system that supports an engagement decision. Technological solutions are an important part of this system, and developing "boxes" that emit friend or foe signals have been at the heart of many CID efforts. However, command and control and battle management operational procedures are also an integral piece of this system. The Air Force's Airborne Warning and Control System (AWACS) is a battle management platform that executes command and control for the air environment. AWACS is one of the critical elements of the CID system that supports engagement decisions in the air-to-air and surface-to-air mission areas.¹⁰ The Air Force has a new battle management platform that became operational in late 1997, the Joint Surveillance Target Attack Radar System (JSTARS). JSTARS is an airborne radar system providing surveillance and target attack information for the ground environment. Among JSTARS battle management functions are command and control and attack support.¹¹ There is potential for JSTARS to become a critical node in the CID system

that supports engagement decisions in the air-to-surface mission area, much like AWACS does in the aerial environment.

This monograph examines JSTARS role in the air-to-surface CID system and concludes that it has the capacity to fuse and disseminate necessary information that ultimately can reduce fratricide in the air-to-surface mission area. This information specifically includes improved target location and identification and enhanced situational awareness, factors that have shown direct links to fratricide. The monograph begins with a theoretical and historical discussion of the nature of fratricide, and highlights importance of the air-to-surface mission area. The monograph reviews the role of AWACS in the conduct of air operations and the role of JSTARS in the conduct of ground operations, and identifies similarities in technology and operational procedures. The monograph analyzes current joint CID efforts, particularly in the air-to-surface mission area and the integration of JSTARS in these efforts. The monograph illustrates how current technological solutions can be coupled with operational battle management procedures through JSTARS to produce an integrated common operational picture of the ground environment that effectively supports engagement decisions in the air-to-surface mission area. Finally, the monograph recommends these CID efforts be expanded and accelerated within joint programs for operational fielding.

II. The Nature of Fratricide

Fratricide has always been a factor in warfare, but it is a difficult problem to analyze. The most descriptive doctrinal definition of fratricide is found in Field Manual 101-5-1:

“The employment of friendly weapons and munitions with the intent to kill the enemy or destroy his equipment or facilities, which results in the unforeseen or unintentional death, injury, or damage to friendly personnel or equipment.”¹²

There are a few different euphemisms for fratricide, such as friendly fire, blue-on-blue and amicide, but all of the terms concern the act of friendly forces engaging other friendly forces.¹³ Friendly combat casualties occur under a variety of different accidental circumstances, but the term fratricide, and its particular euphemisms, generally relate to incidents where there was specific intent of engaging the enemy. The shooter believed at the time of engagement that friendly forces were indeed enemy. As such, these incidents stand apart from other accidental situations in combat. Fratricide is always accompanied by the undeniable horror of realizing that friendly units were fired upon by mistake, and the aftermath of such incidents is far ranging. Fratricide leaves a deep impact on the survivors of the deceased, allied governments involved in such incidents, senior military leaders, and most directly, on the cohesion and morale of units and commanders that remain in combat. Those remaining in combat lose confidence, initiative and aggressiveness. They hesitate to employ combat systems and tend to oversupervise subordinate units and increase restrictive fire measures.¹⁴ The overall result is a loss of combat power against the enemy.

Gen. Norman Schwarzkopf, the Commander in Chief of joint forces during the Gulf War, has perhaps given one of the best characterizations to date of fratricide:

"I detest the term 'friendly fire.' Once a bullet leaves a muzzle or a rocket leaves an airplane, it is not friendly to anyone. Unfortunately, fratricide has been around since the beginning of war. Not even one such avoidable death should ever be considered acceptable. In every after-action report submitted by my former headquarters and those of my component commanders, this problem has been highlighted as one that demands immediate attention and action. All the services are dedicated to finding a technological solution to this long-standing dilemma."¹⁵

Gen. Schwartzkopf not only dealt with the fratricide issue directly in Desert Storm, he also directly witnessed the devastation it leaves behind after the Vietnam War. He spoke at length with the parents of one of his soldiers killed by friendly artillery fire in Vietnam, and was interviewed by the author of a book about the incident.¹⁶ Schwarzkopf believed that the Army was clumsy and evasive about the incident, causing the parents to believe that there was a conspiracy to cover up the truth, thus destroying their faith in their government.¹⁷ The inability of these parents to cope with the nature of their son's death illustrates the most tragic aspect of fratricide: its accidental nature leaves the inevitable conclusion that the incident could have, and should have, been prevented.

This is a vastly different psychological situation from accepting casualties that occur at the hand of the enemy. Casualties that are the result of enemy action seem valid and justified. They are a tragic and unavoidable consequence of the higher moral ground that generally accompanies military action on the part of a nation. There is a tendency even to romanticize and glorify these combat deaths, with such common notions as dying for their country, and giving one's life so that others may live. Such sentiments often accompany notification to survivors from the military. However, casualties as a result of fratricide rarely seem valid or justified. In fact, they generally seem negligent, wasteful, and avoidable. They carry instead the common notion of dying in vain. Fratricide deaths

are the result of mistaken identity, and they lack a connection to the noble cause that may be inherent in the conflict.

The Gulf War offers an incident that illustrates the tension among allied governments that can result over fratricide, as well as the inability to reconstruct accurately what occurred. On February 26, 1991, USAF A-10 aircraft killed nine young British soldiers of the Fourth Armored Brigade. None of the witnesses gave similar accounts of what had happened, and there is conflicting evidence in both the British and American official reports.¹⁸ The British commander, General Sir Peter de la Billiere, stated later in his book, Storm Command, that “the USAF was not in line with our interpretation of events” but that unity of purpose between the U.S. and Britain was absolutely essential, and therefore he was not going to risk the Coalition’s effectiveness by publicly arguing over the circumstances.¹⁹ The incident was played down in the press; yet, General Billiere’s relations with the American air component commander remained strained throughout the conflict.

As the conflicting evidence of this incident illustrates, combat is an inexact art and science, an unpredictable storm of intensely violent emotional activity where participants are never entirely sure of the situation that surrounds them. Participants usually only grasp the larger picture of which they were a part after the fact, once they have had a chance to collect their wits and talk with others, sharing experiences, perceptions, and perspectives. Even then, the interpretation of events can remain difficult to resolve, especially if something so devastatingly intimate as fratricide is involved.

The confusion and chaos of the battlespace has been classically defined by Carl Von Clausewitz in his “fog” and “friction” of war concepts, developed during the early

1800's. Clausewitz understood that war was a complex system. He believed war was in the realm of uncertainty, that three-fourths of the factors affecting combat actions were wrapped in a fog of uncertainty, and that chance made everything even more unpredictable.²⁰ Clausewitz' notion of friction dealt with several aspects of war, including danger, physical effort, intelligence, and the numerous unforeseen minor incidences that permeate a given situation. He believed that these different factors were constantly interacting and influencing an already unpredictable environment. Clausewitz states that in the intense danger of battle, "the light of reason is refracted in a manner quite different from that which is normal in academic speculation."²¹ As for the effect of intelligence on friction, he considered it transient, unreliable, contradictory, and oftentimes false. He believed that one of the most difficult tasks for officers and commanders was to make quick decisions and snap judgments about the information at hand for a given situation. Clausewitz stated, "This difficulty of *accurate recognition* constitutes one of the most serious sources of friction in war, by making things appear entirely different from what one had expected."²²

Clausewitz' fog and friction notions provide a conceptual framework within which to analyze fratricide incidents. The factors influencing a particular decision to engage a given target under a specific circumstance can never be understood completely or explained after the fact by non-participants. When fratricide incidents are examined later in logical, academic settings, the question sometimes emerges as to how the shooter could have possibly mistaken friendly for enemy and fired. Clausewitz lays the foundation for the answer: because the situation appeared entirely different to the shooter

at the time, under combat conditions. The appearance of the situation essentially created the reality of the situation.

Aside from the obvious loss of combat power through unintentional attrition of personnel, fratricide incidents have a tremendous effect on the morale of troops. An incident from the Vietnam War effectively illustrates the personal guilt and demoralizing effect of fratricide. Two platoons had both received word from their company headquarters to expect to encounter enemy troops within a thousand yards. As one lieutenant's platoon moved forward only 150 yards, firing broke out among the lead element. When the lieutenant called out to his signaler to inform the company that it was in contact, his signaler called back that its neighboring platoon had also just radioed contact as well. The lieutenant recounted, "My mouth went dry and my heart skipped a beat as it struck me what was happening. I sprinted forward screaming out for everyone to cease firing." It was too late, and one of the other platoon soldiers had been mortally wounded. The lieutenant felt responsible for what had happened, along with the forward scout that had exchanged the first fire. The guilt of shooting comrades or being responsible for the shooting was impossible ever to remove. The lieutenant also later admitted he was glad his unit did not ultimately come in contact with the enemy, as he was not sure how they would react as a result of the fratricide incident. He was afraid that his troops would have been too cautious and hesitant to engage aggressively, which would have jeopardized their own survival in the face of an actual enemy engagement.²³

This incident illustrates the devastating effect not only on those who inadvertently commit fratricide, but on those left in combat as it undermines confidence in one's own forces. Trust in one's own forces is critical, particularly in joint environments where

interservice cooperation and reliance are necessary for effective integration of different services within different operating environments. For instance, during the World War II Luzon Campaign, consistent attacks by U.S. Fifth Air Force planes on the units of the U.S. XIVth and Ist Corps prompted the U.S. Sixth Army commander finally to take action. He radioed a firm message directly to the Allied Air Forces commander, insisting he take effective measures to stop the bombing and strafing in the vicinity of friendly ground units, as they were repeatedly under fire from their own air forces. The Army commander stated his troops were losing confidence in air support and their morale was being adversely affected.²⁴ This incident illustrates how joint operations can seriously be hindered by fratricide. Ground commanders may opt to forego the benefits air support provides to ground units, deciding that the associated risk is too high.

The Defense Science Board Task Force on Combat Identification convened in 1996 concluded that fratricide was a serious long-term problem that could never be entirely prevented, but that had to be reduced to a practical minimum in any given situation.²⁵ The Task Force identified the real need as minimizing casualties while attaining military objectives, and they emphasized that minimum casualties is usually not the same as minimum fratricide. Additionally, the increasing complexity of the battlespace threatens to exacerbate the fratricide problem. The Task Force identified several factors that have brought increased attention to the fratricide issue: highly mobile joint service operations, reduced tolerance for combatant and non-combatant casualties, highly lethal long-range weapons, changes in the nature of conflict, including limited conflicts, combat zones with civil activity, common weapon systems between enemy and friendly, and overwhelming friendly advantage situations which improve the ability to

attribute casualties to specific shooters.²⁶ The influential nature of these factors is best illustrated through a more detailed look at some historical accounts of air-to-surface fratricide.

III. Historical Cases of Air-To-Surface Fratricide

Fratricide in the air-to-ground environment is a priority concern due to the lethality, speed, and range of modern airpower. Technological advances in military airpower during the last fifty years have far outpaced advances in ground and naval warfare. Most of today's attack helicopters and aircraft have the capability to engage ground targets from beyond visual range, meaning pilots must rely on electronic systems as distance and altitude prevent them from ever seeing the target with their own eyes. This capability alone can exacerbate the risk of fratricide, but other factors include complex command and control relationships between ground and air elements, as well as service specific electronic systems that are not interoperable in joint warfare. Ninety-nine of the 269 cases Shrader documented in his comprehensive fratricide study were a result of ground troops being engaged by their own air forces, a significant 37%. Shrader concluded that air-to-ground incidents clearly predominate, both in total casualties and casualties per incident.²⁷

The incident described in the previous chapter during the Luzon campaign in World War II highlights some of the effects of air-to-surface fratricide on combat operations. Close air support and bombing operations were conducted in the Pacific for three years and most fratricide casualties were primarily attributable to pilot errors in

target identification.²⁸ World War II provides a fertile background in which to analyze fratricide, as it was the first major conflict utilizing modern aircraft with significant range and ground target lethality. World War II also provides the most fatal case of air-to-ground fratricide in history to date, occurring during Operation COBRA in the European theater.

Operation COBRA was the code name for the St. Lo breakthrough in Normandy on 24-25 July 1944. A series of bombing runs was to be made in a small area just in front of the U.S. VIIth Corps. The bombing was designed to disrupt and disorient the heavily dug-in German ground troops, allowing VIIth Corps to penetrate the defensive line. True to the previously discussed Clausewitz notions of fog and friction, a number of unforeseen and developing factors combined to produce a disastrous result: total fratricide casualties for the two day fiasco were 757 men, with 136 killed and 621 wounded.²⁹

The first factor that contributed to the confusion was the weather on 24 July. Air Chief Marshall Leigh-Mallory had determined the visibility was inadequate to proceed with the bombardment plan and ordered a postponement.³⁰ It was impossible to notify and recall every aircraft given the communications technology at that time, so several groups of bombers proceeded on their mission. General "Fighting Joe" Collins, VIIth Corps commander, did receive word that the bombing was postponed and therefore postponed his own subsequent ground attack. When the bombers appeared overhead and began dropping, General Collins was confused as to what was actually occurring, and what was supposed to occur. He did not know if only portions of the operation had been postponed, what role the bombing was now fulfilling, or whether he should in fact

proceed with the ground attack.³¹ Collins ultimately had to commit three assault divisions to restore the front line previously held before the bombing.

The fratricides of 24 July show the high lethality of single errors in air-to-surface engagements. The lead bombardier of a heavy bomber formation inadvertently dropped a portion of his load prematurely as he wrestled with a stuck bomb release lever. The other fifteen bombers in the formation then dropped on his "cue" in accordance with procedure. The bombs fell 2,000 yards north of their target on top of the 30th Infantry Division, killing 25 and wounding 131.³² Additionally, two airmen were killed as another short drop landed on an American airfield and destroyed two bomb-loaded, manned aircraft.³³

Several adjustments were made for the attack on 25 July, including an order that pilots would fly as low as possible to obtain visual identification in an effort to reduce fratricide. Citing the increased stress of incurring more anti-aircraft fire at lower altitudes and the necessity of recomputing target positions enroute due to weather, pilots again incorrectly identified units and bombed friendly positions. Smoke that was used to mark friendly positions had dissipated or dispersed and was useless. Artillery smoke and dust also hampered visual identification by pilots as the ground battle ensued, obscuring markers, landmarks, and terrain features. Follow-on bombers again dropped on cue from lead pilot error. Casualties on the 25th were 111 killed and 490 wounded, and do not include missing personnel and numerous cases of combat fatigue induced by the stressful situation.³⁴

The effects of the fratricide were significant. As during the Civil War, a senior commander was killed by his own side. The bombing killed General Lesley McNair as he was observing the infantry assaults. McNair was the Army Ground Forces commander

and the most senior American officer lost during the entire war.³⁵ The abortive battle on the 24th alerted the Germans and negated the surprise element of the entire operation. Friendly troops were disorganized, attack plans were disrupted, and communications wires had been cut isolating units from their command elements. Commanders had to secure ambulances and tend to fratricide casualties at the same time they were initiating attacks on the enemy. In one severe case, the battalion commander was the only surviving member of the entire 3rd Battalion, 47th Infantry command group, and the unit had to be replaced in the assault.³⁶ The casualties inflicted on the enemy by the bombing were only slightly higher than those of the friendlies. The Germans were dug-in with foxholes and tunnels for protection in anticipation of air attack. The Americans had been hit out in the open, as they had not expected to be bombed by their own forces.³⁷

Air-to-ground fratricide incidents continued in World War II, but none were so deadly in a single operation as in COBRA. Progress in reducing fratricide was made over the course of 1944 as a result of technological improvements in bombsights, visual marking aids and air-ground communication, as well as operational procedure improvements in training, experience, and coordination between sister services.³⁸

Although these improvements may have decreased fratricide during World War II, not enough improvement had occurred over the last several decades in these areas to prevent significant air-to-ground fratricide during the Persian Gulf War. The Gulf War, or Operation Desert Storm, occurred in 1991, some 47 years after World War II. Yet an analysis of these more recent incidents shows that the same errors were committed: ineffective visual aids, target misidentification, target location errors, and poor air-ground coordination between sister services. General Charles Horner, the Joint Force Air

Component Commander during Desert Storm, gave very specific guidance concerning close air support of ground Coalition forces, "I do not want fratricide. So if in doubt, don't shoot."³⁹ Despite this specific guidance during a very short war in which joint forces had an overwhelming combat advantage, there were nine air-to-ground fratricide incidents out of a war total of twenty-eight.⁴⁰ This ratio of 32% is consistent with Shrader's air-to-ground finding of 37%.⁴¹

One of the most political incidents was discussed earlier in Chapter Two, the attack of USAF A-10's on British armored personnel carriers. This single incident resulted in nine deaths and eleven wounded. The American pilots claimed they had been cleared to engage vehicles inside a four-kilometer grid square by the British forward air controller, and that the controller told them no friendlies were in the vicinity. The pilots conducted two visual identification passes at 8,000 and 15,000 feet, rather high for visual ID. They believed the British personnel carriers were Iraqi T-54/55 tanks, in spite of the British using the agreed upon vehicle visual aids of large inverted "V" markers and bright orange panels.⁴² The forward air controller insisted he had radioed coordinates many miles away from where the engagement took place. It was later determined that the colored panels and inverted "V" signals could not be seen from above 5,000 feet.⁴³

Another serious incident involving multiple casualties occurred on January 29, 1991. A Marine reconnaissance team was manning one of the old police posts on the border of Iraq and Kuwait near Umm Hajul. Iraqi mechanized vehicles from the 1st Division were spotted three miles out and headed right for the Marine outpost. These vehicles were on a mission to protect the western flank of the Iraqi III Corps attack against Wafra and Khafji. The recon team radioed for air support and reinforcement by a

battalion of light armored vehicles (LAVs) behind their post. A fierce ground battle ensued, but the Iraqis outnumbered the Marines. They surrounded the outpost and threatened to overrun it. A ground-to-ground fratricide occurred as one Marine LAV from a company in the reinforcing battalion fired on one of the reconnaissance LAVs attempting to withdraw from the battle. Four crewmembers were killed.⁴⁴ In order to prevent more fratricide, the Marine company commander ordered all of his LAVs to concentrate their fire in the direction of the most threatening tanks. He hoped that close air support attack planes that had just arrived would follow the tracer stream away from the friendlies and identify the enemy tanks.

However, the USAF A-10's overhead could not visually sort identities on the battlefield. The pilots reported seeing lots of vehicles and blinding flashes, but could not discern firing units or direction of fire. Through radio communication with a Marine forward air controller, the pilots dropped a flare on the Marine position and asked for enemy positions relative to the flare. Other frantic Marines covered the burning flare with dirt, as they feared it was illuminating their silhouettes for the Iraqi gunners. The result was a Maverick missile engaging another LAV, killing seven and wounding two.⁴⁵ In four hours of combat, the Marines had lost none to Iraqi gunfire, but eleven to fratricide.⁴⁶

The difficulty of effective ground identification is evident in joint operations, but a final Desert Storm incident that gained media attention was within a single service. On February 17, 1991 a U.S. Army AH-64 Apache attack helicopter on an armed reconnaissance mission fired on an Army Bradley fighting vehicle and an armored personnel carrier. Two soldiers died and six were wounded.⁴⁷ This case received much

attention because the pilot of the helicopter was the Apache battalion commander. The Army investigation concluded that pilot error led to poor situational awareness and misidentification of the friendly vehicles. It also cited the lack of the commander to exercise proper command and control over the Apache team due to his personal participation in the fighting.⁴⁸

The battalion commander flew with the team because this was the first night mission in support of ground troops for his unit. He was concerned over the winds and low moonlight illumination. He considered himself the most qualified pilot in the battalion. This is a prime example of how combat can affect perception of the situation. A very qualified and expert pilot misread his navigational data, was flying in a different direction than he thought, and engaged targets at a different grid coordinate than what the friendly ground troops had reported.⁴⁹

These historical cases illustrate the major factors in fratricide: errors in target identification and/or location and loss of situational awareness. Accurate target identification is a key element in the decision process that leads to weapon system employment. To summarize, another definition of combat identification is offered: the process of attaining an accurate characterization of detected objects in a combatant's area of operations to the extent that high confidence, timely application of tactical options and weapons resources can occur.⁵⁰ In order to exact high confidence and timely application of weapons, the engagement decision process needs to be understood.

The targeting decision process is a six-step cycle: detection, tracking (location), identification, targeting, engaging, and assessment.⁵¹ Platforms that execute reconnaissance, surveillance, and target acquisition functions such as AWACS and

JSTARS play a prominent role in the detection, tracking location, identification, and assessment phases. Given modern combat weapons, a shooter may not have much time to work through the cognitive engagement process. Fear also factors into the process as the natural survival instinct. The shooter may feel trapped in a “kill or be killed” situation. Radar battle management platforms such as AWACS and JSTARS can help optimize the decision time available to the shooter in a given tactical situation, as well as assisting in the steps of the process. This concept will be examined in detail in Chapters Five and Six.

Combat ID has been called the most critical element of combat operations at the tactical level.⁵² A review of the status of current CID efforts is necessary to evaluate the potential impact on fratricide in the next military conflict.

IV. Current Status of Joint Combat Identification Efforts

As the historical cases indicated, fratricide in Desert Storm was a serious issue. The statistics were grim: 146 combat deaths, with 35 from fratricide (24%), and 467 wounded, with 72 from fratricide (15%).⁵³ These rates catapulted combat identification to the top of military priority lists, where it has remained throughout the decade. The Joint Requirements Oversight Council formed a General Officer Steering Committee on Combat Identification after validating a Combat Identification Mission Needs Statement in 1992.⁵⁴ This statement was reviewed and revalidated in 1998 by the Joint Staff, the Services, and the Commanders-In-Chief (CINCs) of all the unified commands. Two organizations were placed under the Joint Staff's Force Structure, Resources, and

Assessment Directorate ("J8") in 1992 with primary responsibility for joint CID: the Joint Combat Identification Office (JCIDO) and the All-Service Combat Identification and Evaluation Team (ASCIET). Each service also initiated their own service-specific CID efforts.

The General Accounting Office (GAO) reviewed near-term service efforts and sent a report on Combat Identification Systems to congressional committees in September 1995.⁵⁵ The GAO was concerned that the services, specifically the Army and Navy, were procuring major CID systems without a cohesive management plan or structure. The GAO criticized the lack of joint integration within the systems, and also the lack of jointly developed cost and operational effectiveness analyses. Service specific procurement plans could ultimately result in having to field several different systems on individual platforms in order to ensure interoperability.

The GAO report highlighted the fact that in spite of very top-level efforts; not much progress had been made for joint CID. The reasons for the lack of progress were enumerated by the Director of the J8 Staff in an August 1997 memorandum to the Chairman, Joint Chiefs of Staff.⁵⁶ He stated that the General Officer Steering Group was not empowered to mandate joint efforts among the services, the chain of command was ineffective, the JCIDO personnel were not assigned on a stable full-time basis, and the ASCIET evaluation process was too cumbersome and slow. In spite of CID being a top Secretary of Defense priority, no visible impact on improved warfighting capability had yet been realized. His recommendations for reorganization were approved by the Chairman, and are currently being implemented. As a consequence, there is still no effective overarching agency providing vision and focus for joint system CID integration.

In an information paper to the Chairman, Joint Chiefs of Staff, the Director of JCIDO noted Congressional criticism of Department of Defense CID efforts. He stated that congressional focus is on zero fratricides and a "silver bullet" technological solution, but that JCIDO's efforts are focused on reducing fratricides while maximizing weapon systems employment.⁵⁷ This is an important distinction for the military. Fratricide can be minimized with restrictive rules of engagement and tightly controlled employment procedures. However, this also reduces the flexibility and authority of commanders at all levels to fight the war, and it negates the technological advantages of long-range weapons systems. The result of highly restrictive combat measures is an overall loss of initiative and combat power. JCIDO is still completing a comprehensive two-phase assessment of Combat ID across all services. Phase 1 is completed but only makes general recommendations regarding the need for interoperability, positive ID sensors, and rectifying fusion and correlation issues.⁵⁸ However, these types of recommendations were evident at the close of Desert Storm nearly ten years ago. Implementation strategies for addressing these needs are still lacking. Clearly, fielded solutions do not appear near-term within this process.

Many defense contractors have responded to the CID requirement and appear to be in line with congressional desires to field "silver bullet" technological solutions. Military contractors have produced systems that offer varying degrees of identification of friendly units, from interrogation systems to transmitters and beacons, installed on everything from aircraft, tanks, and trucks to individual soldiers. At the last Joint Service Combat Identification Systems Conference in 1998, the emphasis was clearly on technological developments in all areas, with no presentations on joint operational

procedures or integration efforts. With the exception of one Air Force briefing on requirements, the Conference consisted wholly of over forty new or enhanced technology briefings and papers from defense contractors and government research and development agencies.⁵⁹ This definitely seems to support JCIDO's assessment that the primary focus is on finding technological solutions within the defense industry. The Conference Report foreword stated that the presentations were indicative of the large-scale growth in the development of CID technologies. The problem is that there are no integration or synchronization efforts within this technology explosion aimed at providing a systemic solution within specific CID mission areas.

As the GAO report noted, individual "stovepipe" technology development is not cost-effective for the military, most particularly when one or more services will ultimately have to incorporate the new technology on perhaps hundreds of combat elements. This is especially true in the air-to-ground mission area. Incorporating a new "box" on the vast majority of air-to-ground aircraft and on the hundreds of ground combat vehicles would be cost prohibitive. The answer to fratricide is not just new technology. The real answer needs to be cultivated from a systemic operational approach and should ideally incorporate successful technologies that service components have already fielded.

This need has been recognized in a 1999 draft document that has not been finalized for publication yet. U.S. Atlantic Command (USACOM) took the lead in developing a Combat Identification Capstone Requirements Document to provide a joint unified doctrinal basis to guide the operational aspect of Joint CID. This emerging doctrine further characterizes the current shortcomings with the joint CID process: lack of current CID systems to provide ID beyond weapon range, lack of interoperability between

service systems, proprietary and out-dated technologies expensive to modify and maintain, target ID systems that do not automatically share data with common command and control systems, and loss of data integrity among systems that do attempt to share information.⁶⁰ The document notes that technology alone is inadequate to ensure maximum combat effectiveness and minimum fratricide. Likewise, training, tactics, techniques, and procedures alone are also inadequate. The underlying thesis of the document is that piecemeal solutions to different parts of the problem will not add up to an effective operational solution, although this is not definitively stated in the text.

The USACOM Capstone document does suggest a "system of systems" approach, with many elements integrated into one comprehensive network. This concept has produced effective results in the air-to-air and surface-to-air mission areas, which will be examined in the next chapter. The Capstone document proposes that a diverse combination of systems and data are needed to produce positive knowledge of friendly force locations, enhanced situational awareness, and positive cooperative and non-cooperative identification, a "CID Family of Systems architecture."⁶¹ Unfortunately, the Capstone requirement document is not authoritative doctrine for the joint community.

Yet a systemic approach seems to be the only logical answer. In line with general systems theory, solving complex problems involves more than focusing on isolated parts of the whole. Effective systems must be adaptive to their environment and responsive to all elements within the system. Peter Senge noted in his book, The Fifth Discipline,

"Perhaps for the first time in history, humankind has the capacity to create far more information than anyone can absorb, to foster greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace. Organizations break down, despite individual brilliance and

innovative products, because they are unable to pull their diverse functions and talents into a productive whole.”⁶²

Senge was writing for the business management world, not the military. But his observations are particularly relevant to fratricide and the complexity of the modern battlespace and well summarize the problem within the military. The focus on joint warfighting is now the primary element within military doctrine; however, integrating four separate, distinct services into a seamless whole remains an elusive goal.

An effective joint CID system needs to be interoperable, integrating all the diverse methods and components from the different services into some type of “common operational picture” that can increase accuracy and timeliness within the targeting decision process. This common picture should also help alleviate the fog and friction of combat, simultaneously contributing to increased situational awareness for as many combat participants as possible.

The conclusion of this review of the current Joint CID process is that fielded responses to the fratricide problem are not near-term and are not yet likely to yield significant results in the next major conflict. The air-to-ground mission area continues to suffer under the current joint CID process, in spite of being recognized as one of the critical mission areas. At the 1998 Combat Identification Systems Conference, the General Officer Steering Committee rated the current air-to-ground CID capability as unsatisfactory. At the same conference, Air Combat Command ranked air-to-ground CID second out of 123 prioritized mission needs.⁶³ A 1998 Joint Requirements Oversight Council memorandum placed the air-to-ground mission area as second priority among the four mission areas.⁶⁴ However, without a single agency coordinating and integrating joint

technological developments with joint operational procedures specifically within the air-to-ground mission area, an effective near-term systemic solution does not appear within reach.

V. Analysis of Systemic Success within the Joint Air Combat ID System:

In spite of the high fratricide rates in the Gulf War for the surface-to-surface and air-to-surface mission areas, there were no fratricide casualties in the air-to-air or surface-to-air areas.⁶⁵ The Gulf War is also the first conflict in history in which a large percentage of air-to-air kills against enemy aircraft, 48%, were executed beyond visual range of the pilots. This was directly attributed to the fact that fighters operating in conjunction with AWACS could fire beyond visual range with little risk of accidentally firing on friendly aircraft.⁶⁶

The Defense Science Board Task Force analyzed the role AWACS has in joint air CID. They cited it as an example of the capability that large, centralized assets have in quality CID distribution.⁶⁷ The Task Force also noted that the role of JSTARS merited further exploration in supporting CID for both battle management and fratricide. AWACS and JSTARS attract this attention because they are premiere radar command and control systems capable of performing a variety of battle management functions across the spectrum of conflict. Both of these airborne radar systems can provide wide-area, long-range views of their respective coverage areas, as well as small-area tactical amplification of specific targets and engagements. This chapter examines the success of

the joint air CID system⁶⁸, the systemic integration of various air and ground components, and explains how the unique functionality of AWACS is a critical node.

AWACS is an essential element in the Theater Air-Ground System. The Multi-Service Procedures manual for the Theater Air-Ground System enumerates the various factors that contribute to an effective air defense system: sensor employment, identification procedures, engagement procedures, airspace control measures, weapons control procedures, weapons system employment, tactical interface design (datalinks), and dissemination of early warning.⁶⁹ It is evident that technology is a part of the system, as well as operational procedures. The system is not focused only on information (detection), but also on how that information is validated and disseminated throughout the theater.

Joint Doctrine for Countering Air and Missile Threats, Joint Publication 3-01, is an authoritative manual for the joint air environment and describes the system supporting aerial ID and engagement decisions. This doctrine states that command, control, computer, communications, and intelligence (C4I) systems are the heart of effective counterair operations. Joint Publication 3-01 states that C4I resources must be capable of rapidly exchanging information, interfacing with all components, and displaying a common operational picture to all components of concern.⁷⁰ These C4I systems are connected to commanders at decision and execution levels to integrate forces and missions. The C4I systems are interoperable, survivable, reliable, and provide redundancy. C4I systems use a combination of procedural and positive ID processes to identify friend or foe. These processes are part of a systemic network consisting of air traffic control facilities, radar control units, airspace users, and commanders that utilize

reliable voice and data nets, radar, electronic identification friend or foe technologies, and selective ID features. The goal of this interoperable network is to provide accurate and timely ID to enhance engagement of enemy aircraft and missiles, conserve friendly resources, and reduce risk to friendly forces.⁷¹ Joint Publication 3-01 further defines AWACS and JSTARS as national C4I assets so important to joint operations that the loss of even one of these high value aircraft could seriously impact US warfighting capabilities.⁷²

The Multi-Service Procedures for the Theater Air-Ground System also states that AWACS is usually the first C4I platform to arrive in a theater of operations. AWACS is normally tasked with establishing the initial C4I system capability and for providing early warning, surveillance, battle management, weapons control, and CID.⁷³ It is important to note that radar functionality is a critical factor in AWACS ability to execute these taskings for the C4I network. Radar is necessary to ensure the quality and accuracy of disseminated data information. AWACS fuses information from other C4I sources with it's own radar picture and has the responsibility of ensuring the integrity of the disseminated common air picture.

These common pictures on various levels of combat have emerged as a way for commanders to manage the complexity of the modern battlespace. The last decade has seen a rise in computer based programs fed by various sensors and systems that are tools for operations centers in executing command and control and administrative functions. Emerging doctrine is attempting to classify the various common pictures within the battlespace as they nest from the tactical to the strategic level. The Joint Theater Air Missile Defense Organization has offered a logical relationship: the Single Integrated Air

Picture represents the real-time air track portion of the Consistent Tactical Picture. The Consistent Tactical Picture depicts in near-real time the complete tactical picture of the battlespace (air, surface, sub-surface). The Consistent Tactical Picture feeds the Common Operational Picture, which is a non-real time depiction of the entire Joint Force Commander's area of responsibility.⁷⁴ These pictures deal with the execution and monitoring of the battlespace situation. The requirement is still to get the most completely integrated, accurate, timely picture combining all components, specifically, the Common Operational Picture should ideally be as real-time as possible. These common pictures are a subset of larger computer command and control systems that can also plan future operations, provide combat readiness status for various joint elements, organize intelligence data and basically provide information from tactical to strategic levels of conflict.⁷⁵ Individual elements within this common picture network range from aircraft pilots and small radar control facilities, to the theater Air Operations Center, the Joint Force Commander, and to sector, regional, and headquarters units that are part of the North American Air Defense System.

These common pictures are important because they strive to provide a comprehensive, integrated, timely, joint depiction of the battlespace that is common to all participants and increases joint situational awareness. In the air defense environment, this networked system ultimately produces an identical, robust, accurate representation of the common recognized air situation to all joint air control elements in the theater. It is not error free, but it has consistently supported high confidence air engagement decisions and minimized fratricide within the air-to-air and surface-to-air mission areas.⁷⁶ The Recognized Air Picture or Single Integrated Air Picture is not a situational awareness

picture created in one location and passed to others, nor is it a network within itself. It is a resulting synergistic product of many individual user inputs of specific information that is quality-controlled and shared across several diverse networks.

One of the most important functions of common pictures is their ability to support engagement decisions. As was noted in previous chapters, pilots do not always have an accurate perception of the combat situation, nor do they have a "big picture" assessment capability with their onboard systems. Battle managers executing weapons control functions for attack aircraft from radar C4I platforms can provide a wide variety of information to shooters as they approach engagement. This is precisely what AWACS does for pilots in the air environment.

Air Battle Managers onboard AWACS can assist individual pilots in almost all phases of the targeting process: detection, verifying location (tracking), providing or confirming identification, targeting, and post-attack assessment. They have radar information such as point of origin and track history characteristics to facilitate the ID process, they can validate electronic ID information if available, and they can cross-cue ID information with other C4I and/or tactical sources. The fact that Air Battle Managers on AWACS are in voice contact with all shooters is a primary factor in effectively executing real-time engagement decisions and maximizing weapons resources.

AWACS Air Battle Managers also monitor and facilitate execution of the theater-wide Air Tasking Order. This means that they have situational awareness on the operational level air war as well as on individual tactical engagements occurring within the area of operations. Air Battle Managers onboard AWACS are in a unique position to simultaneously monitor and execute both tactical and operational level command and

control for the air war. This is one of the most important capabilities of this platform. Air Battle Managers on AWACS have the ability to assess the tactical and operational situation, integrate critical pieces of information, and then disseminate this analysis in a real-time manner to a multitude of air combat participants in support of air engagements as well as other air operations.

There are some interesting points relative to the air CID system that may lend insight into the difficulties of ground CID. Joint doctrine states that a common frame of reference is absolutely essential for air defense units to integrate actions and minimize fratricide, and further states that the common frame of reference will be provided through the Air Tasking Order and the Common Operational Picture.⁷⁷ As noted, AWACS is a radar battle management platform uniquely suited to monitor execution of the Air Tasking Order as well as validating and disseminating the Common Operational Picture at both tactical and operational levels.

The next chapter will examine the effect of ground CID system in terms of reducing air-to-surface fratricide. It will illustrate that synergistic products that have been effective in reducing fratricide in the joint air CID system are lacking in the joint ground CID system. Specifically, it lacks a similar common frame of reference for ground units that spans operations from tactical to operational levels in real time for maximum joint situational awareness. Most importantly, the chapter will highlight that the current ground CID system has no secondary effect for the air CID system that could contribute to increased confidence in the air-to-ground engagement decision process.

VI. Analysis of Joint Air-to-Ground Combat ID

The lack of effective ground-to-ground CID significantly affects air-to-ground fratricide. Positive identification of all individual ground elements throughout the entire battlefield is most likely an unattainable goal. However, as the last chapter illustrated, there are systematic measures that may be able to increase the confidence level within individual engagement decision processes that shooters conduct. As the Defense Science Board Task Force noted previously, the goal should not be the elimination of fratricide, but the reduction of it to an acceptable level. Since these systemic measures have succeeded in reduced fratricides in the joint air CID system, perhaps they can be leveraged to produce some success in reducing fratricide in the air-to-surface mission area. Air-to-surface CID is applicable across a spectrum of missions beyond close air support. Interdiction, theater missile defense, suppression and/or destruction of enemy air defenses, and combat search and rescue all benefit from advances in air-to-surface CID.

The primary causes of air-to-ground fratricide cited in joint doctrine are misidentification of targets, target location errors, and loss of situational awareness by terminal controllers and/or pilots.⁷⁸ A system that effectively reduces air-to-ground fratricide needs to provide accurate and timely information to airborne shooters and terminal controllers that increases their situational awareness of the ground environment, validates or confirms target location, and ultimately facilitates a more confident assessment of friend or foe identification during the engagement decision process.

An explanation of important facets of the Theater Air-Ground System is required to illustrate some of the problem areas in air-to-ground fratricide. This explanation will

also provide the operational framework to illustrate how JSTARS might assist in the CID process that will be covered in the next chapter.

Terminal controllers as referenced above are Forward Air Controllers (either ground or airborne) or they can be members of the Tactical Air Control Party that is collocated with Army maneuver units from battalion through corps. These people directly control aircraft executing close air support onto desired ground targets through radio contact. Their primary responsibilities are airspace coordination and deconfliction of fire support to prevent fratricide.⁷⁹ Chapters Two and Three discussed how many air-to-ground fratricides involve different perceptions between terminal controllers and pilots, as well as disagreements over such factors as target location coordinates or direction of fire instructions.

From the time aircraft executing close air support missions take-off until they approach their target area, they are under positive radar control with AWACS. AWACS then "hands them off" via radio to either JSTARS or the Airborne Battle Command and Control Center (ABCCC) as they approach the target vicinity. JSTARS and ABCCC then execute procedural control over the aircraft because they do not have air radar systems that allow positive control. JSTARS is a ground radar system and ABCCC has no radar system. JSTARS and/or ABCCC then hand off the close air support aircraft to the terminal controllers via radio as they begin their final descent and entry into the airspace over the applicable friendly ground units. These tactical command and control procedures are outlined in several different joint and service publications.⁸⁰

It is also important to clarify that the joint air-to-ground operating environment can involve a variety of platforms from all services. All four services have assets that can

execute close air support missions. The Air Force, Navy and Marines have fixed wing aircraft and the Army has helicopters that perform this mission. Army or Marine Corps units conduct close air support for their ground operations. Due to the operational concept of the Marine Corps, they generally try to provide close air support for their ground units with their own air assets. Consequently, the greatest number of close air support missions and the most usual situation is when Air Force air assets conduct close air support for Army ground units. However, as evidenced by the previously discussed Desert Storm historical cases, joint combat operations may result in any combination of air assets and ground units from different services attempting to facilitate close air support in critical situations. Additionally, Special Operations Forces are joint units that may operate in conjunction with ground and air assets from all services across a variety of missions.

This is the primary reason that non-interoperable CID technologies and systems internal to respective services will not effectively reduce fratricide in the air-to-ground mission area and are not cost effective for the Department of Defense as a whole. The variable joint nature of the air-to-ground mission area and the corresponding high fratricide rate also indicate that there must be deficiencies in joint operational procedures. In spite of a multitude of joint and service manuals that direct the complex procedure of close air support, the system does not effectively minimize fratricide.⁸¹

The result is that specific shortcomings in joint CID for the air-to-surface mission area center around complex joint air-to-ground operational procedures and technological deficiencies.⁸² These include the fact that discrimination of enemy ground forces is currently either done procedurally (positional information) or through direct control from

terminal controllers. There are shortcomings in the accuracy and timeliness of positional information. Direct control suffers from reliance on voice communication and a lack of accurate ground-to-ground CID. The ability to identify ground combat elements is largely visual for both pilots and terminal controllers, therefore marginal in daylight and deficient at night. Also, the lack of joint doctrine to establish necessary standards in equipment and tactics, techniques, and procedures hinders effective training and execution of joint close air support.⁸³

The Desert Storm fratricides confirm that the reliance on visual aids as a primary means to identify friendly vehicles from the air was ineffective, just as it was in World War II. It is interesting to note that between the two conflicts were fifty years of dramatic technological improvements in combat systems, yet colored panels and smoke were still the methods of choice by senior commanders for identification of ground units by airborne shooters.⁸⁴

Terminal controllers operate under much the same limitations as pilots do. They have a very small-area tactical perspective of the battlespace. Their ability to cross-cue information for increased situational awareness is limited, as is their radio connectivity. Terrain is a major consideration for ground terminal controllers. Close air support procedures require they maintain visual contact on the target for engagement. They oftentimes lose visual contact due to terrain and target maneuvering and are unable to provide accurate location coordinates when the aircraft is ready to engage.

Procedural control measures are a part of this complex system of air-ground coordination. One of the primary control measures of the battlespace is the Fire Support Coordination Line (FSCL). The FSCL is a line established by the appropriate ground

force commander to ensure coordination of fire not under their control that may affect tactical operations in their area.⁸⁵ The FSCL is used to coordinate fires of air, ground, or sea weapons systems against ground targets. This means that air assets may engage targets out beyond the FSCL without coordinating with ground commanders, but they must coordinate if the targets are behind the FSCL.

Placement of the FSCL is very important in joint operations and has long been a contentious issue between the Army and the Air Force. As discussed previously, restrictive operational procedures such as the FSCL may reduce fratricide but also limit flexibility, initiative, and autonomy in the battlespace. Army commanders normally want the FSCL to extend out as far as their deep attack systems, such as the Apache helicopter, can engage. This in turn reduces the amount of space in which air commanders can engage ground targets. This is exactly what occurred in Desert Storm as the respective Corps commanders wrestled with FSCL placement.

During the four-day ground campaign in late February 1991, the Army rapidly kept advancing the FSCL boundary farther out so that it could operate its Apaches more freely and effectively. On February 27, General Gary Luck, commander of XVIII Corps, placed the FSCL north of the Euphrates River specifically to allow Apaches to attack the causeway and the roads north of Basra.⁸⁶ However, only a few Apache attacks had been carried out by late afternoon, and the FSCL prevented the Air Force from striking the Iraqi forces that were escaping across the river. As a result, Iraqi forces escaped by moving on a major road for almost eight hours with minimal losses. The FSCL also created problems for VII Corps. General Fred Franks was worried that his divisions were rapidly going to break through Iraqi defenders and charge the coast, where the Air Force

was freely engaging Iraqi forces. Worried about fratricide, Franks ordered the FSCL shifted east of the coastal highway leading north from Kuwait City. After directing the change, the ground troops slowed down in battle and the likelihood of reaching the area decreased. However, the new FSCL position was now restricting air assets from bombing the Iraqi troops escaping on that road.⁸⁷ The end result of both of these incidents was that significant Iraqi forces escaped, in spite of available attack assets.

These Desert Storm situations illustrate that while fire control measures and procedures are in place to minimize fratricide, they ultimately may significantly inhibit the joint warfighting capability. Gordon and Trainor cite in The General's War that the positioning of this boundary was one of the most important miscalculations in the final hours of the war.⁸⁸

The final problem in the air-to-ground CID mission area is the lack of accurate ground-to-ground CID systems that are interoperable or fielded significantly across ground elements. Ground-to-ground CID efforts have primarily been developed under a single service. The Army is currently fielding the Battlefield Combat Identification System.⁸⁹ This system works similar to the friend or foe interrogators on aircraft: it is defined as a "question and answer" technology in which a shooter elicits a positive or negative electronic response from a transponder on a suspected target. The Army plans to incorporate this system on tanks, fighting vehicles and its attack helicopters. However, there are no plans to incorporate this same technology on air-to-surface mission aircraft, or on any shooters outside of the U.S. Army. This is another major example of the lack of joint effort in CID. The Army has \$89 million programmed to procure this system

from 1999-2003; however, this system does not integrate with any USAF, Naval or Marine air assets that perform close air support roles.⁹⁰

A different system was found to be more effective for fixed-wing aircraft performing close air support of ground troops. This system is called the Situational Awareness Data Link and is currently being procured by the Air National Guard and Reserves.⁹¹ However, the Air Force requirement for this system is only for Guard and Reserve assets that perform close air support, not for regular USAF assets. The regular Air Force assets already possess a different data link, the Joint Tactical Information Distribution System, which is a cornerstone of the Recognized Air Picture.

The joint deficiency of all these different electronic systems is that they do not contribute to a single common integrated picture for the ground situation. They are not networked together to produce a synergistic product in the way that the joint air CID system is. They are also expensive for their respective services, since they require fielding on every individual asset to allow that asset to transmit and receive information on its respective datalink. While each of these systems may contribute to a reduction of specific CID problems within their respective service, they are not being developed or integrated with a joint focus. Efforts to make them jointly interoperable after development and procurement are even more costly and time consuming. Furthermore, the efforts in ground-to-ground CID are not being developed with an overlapping requirement to assist with air-to-ground CID.

The Defense Science Board Task Force noted that CID does not result from a single device or process, and that it was not a necessary requirement to equip everyone alike.⁹² They believed that joint CID in the future should be made up of a system of

different tools: direct and indirect, surveillance and networking, cooperative and non-cooperative. As discussed in Chapter Five, the joint air CID system is an example of this type of evolving system. It is still being modified and improved, particularly in terms of missile threats, but it has already been effective in reducing fratricide. Given this and the Task Force's earlier recommendation to utilize large centralized assets within a distributed CID network, JSTARS may be an effective near-term solution to integrate the variety of stovepipe datalinks being procured that were identified in this chapter.

The next chapter will examine the JSTARS system and how its capabilities might be leveraged in the joint battlespace to reduce air-to-ground and ground-to-ground fratricide.

VII. The Role of the Joint Surveillance Target Attack Radar System

The last few chapters have laid the framework for analyzing the critical role JSTARS may play in the CID process. Due to JSTARS wide and small-area ground radar surveillance function, its airborne C4I capability, and a joint Army and Air Force crew, JSTARS can assist air and surface operations from the tactical to operational level.

Specific capabilities possessed by JSTARS include the organic radar capability for surface moving targets as well as imagery of fixed surface targets. JSTARS shares a system-unique datalink with the Common Ground Station (CGS). Although the original CGS design intent was to provide connectivity specifically between the aircraft and the Army, a number of different ground station variants have emerged in the last several years increasing joint flexibility.⁹³ These ground stations allow JSTARS data to be

incorporated by the Navy directly onto command and control ships such as the Coronado and the Mt. Whitney, in support of littoral operations.⁹⁴ Additionally, the Marine Corps uses JSTARS data to support both amphibious and ground operations, demonstrating this capability in Advanced Warfighter Experiments.⁹⁵

JSTARS also has the mandated Defense Department Joint Tactical Information Distribution System (Link 16). Link 16 allows JSTARS to disseminate information through that vast network, providing connectivity far beyond the system-unique ground stations. The dissemination of JSTARS data to surface command and control and fire support nodes facilitates decision making and targeting.⁹⁶ This network already allows JSTARS to effectively integrate and distribute diverse battlespace information into existing common pictures. The relevance to CID, particularly in the air-to-surface mission area, is specifically from this resultant increased situational awareness, increased accuracy in target location, and higher confidence level for target identification.

The Multiservice Procedures for the Theater Air-Ground System defines JSTARS as an integrated Army-Air Force command and control, battle management, surveillance, target detection and tracking platform.⁹⁷ This doctrine describes how onboard Air Battle Managers use data collected by the JSTARS sensors to build a common tactical picture, and to provide guidance to attack platforms. JSTARS overall function is to contribute to an understanding of the enemy ground situation and support missions to delay, disrupt, and destroy enemy ground forces based on the Joint Force Commander's overall objectives.⁹⁸

The missing doctrinal piece so far is positive location of friendly forces. JSTARS has various capabilities to incorporate friendly information from a variety of fielded

systems. This is what ultimately puts JSTARS in a unique position as a fusion center for surface friend or foe information. The information can be confirmed and validated through radar sensors, external cross-cueing, and voice communication, and then disseminated through the diverse joint datalink network. The overarching goal should be a product modeled on the successful joint air system: a linked, dynamic network of individual elements that each contribute to a synergistic product (a single integrated ground picture) that can be disseminated from the tactical to strategic level.

Those individual ground elements incapable of physically receiving this picture still benefit from the product through voice nets from platforms that are receiving the picture. In the close air support process, company and platoon elements can benefit through their terminal controllers and attack aircraft. JSTARS role in close air support was detailed in Chapter Six. JSTARS can help address terminal controller and pilot limitations previously identified: broadening small-area tactical perspective, cross-cueing information, validating location coordinates, and maintaining maneuvering target awareness. JSTARS electronic system compliments visual limitations, and both combine for synergistic effects in terrain-challenged areas.⁹⁹ The end result is increased situational awareness, reduced target location errors, and higher confidence target identification.

Joint attack support procedures involving JSTARS have been incorporated into service and joint doctrine as the result of exercise and training events over the last two years of JSTARS operational experience. These doctrinal procedures have been coordinated and accepted by the respective attack asset units, from fixed-wing aircraft to Apache helicopters. The procedures include specific voice communications, target

information and format (including J-FIRE 9-line messages), and mission planning considerations.¹⁰⁰

The number of different user communities requesting JSTARS information has grown dramatically in a few short years. As this paper has pointed out, there is also a wealth of CID technology currently available. This situation prompted Air Combat Command to host a Joint CID Conference in March 1999. The purpose of the conference was to begin a systematic process for formulating a long-term JSTARS CID baseline. The conference specifically analyzed JSTARS ability to interface with several different CID systems currently available within the joint community.¹⁰¹

JSTARS can utilize Grenadier Beyond line-of-sight Reporting and Tracking (BRAT) information, a system currently used by the Marine Corps as well as Special Operations Forces. JSTARS can receive Collection of Broadcast of Remote Assets (COBRA); a National Reconnaissance Office system currently being procured by the Army and currently used by Special Operations Forces. JSTARS can receive Emergency Position Locating and Reporting System (EPLRS), an Army system. JSTARS can receive the Situational Awareness Data Link (SADL); a system that interfaces with EPLRS and is used by Air National Guard and Reserve close air support assets. JSTARS interfaces with Situational Awareness Beacon with Reply (SABER), a system fielded by the Navy that also utilizes EPLRS. JSTARS can integrate an Automatic Target Recognition (ATR) capability, through its Air Force program. Interfaces with these systems have grown out of informal user requirements and were developed specifically within the JSTARS program community.¹⁰²

This robust fusion capability and its associated importance to joint CID has been demonstrated and evaluated in exercises conducted by the All-Service Combat Identification and Evaluation Team (ASCIET), which was introduced in Chapter Four. The annual ASCIET exercises are important because they are controlled CID evaluation environments. They utilize their systems to collect and analyze exercise data and provide both quantitative and qualitative assessment.¹⁰³ ASCIET can not only review CID results, they can determine if the ID was available in the battlespace, trace its routing and measure the resulting combat effectiveness.

ASCIET 97 involved a specific objective to assess the contribution of JSTARS to ground CID.¹⁰⁴ The scenario involved a Marine Corps battalion Combat Operations Center controlling a Light-Armored Reconnaissance company reinforced with a tank platoon and supported by a simulated artillery battery. Grenadier BRAT CID information was utilized in the exercise. Operations Center personnel used JSTARS reported target locations for prosecution with close air support, artillery, and ground maneuver forces.

The final evaluation report cited these results: JSTARS provided the Operations Center a situational awareness advantage over the opposing force, Grenadier BRAT cross-cueing provided positive friendly location information and also allowed enemy position to be relatively determined, JSTARS data was accurate enough to support its use as a targeting source and for target cueing to position friendly forces for ID and engagement, JSTARS provided direct support to forward air controllers (FACs), JSTARS could provide target location to attack aircraft in the absence of FACs or beyond the range of FAC and forward observers, and JSTARS could provide situational awareness to attack aircraft if they lost communication with their FAC.¹⁰⁵

The air-to-ground fratricide rate for the exercise was promising, at approximately 7%. Close air support aircraft out of seventy engagements engaged three friendlies and two non-participants.¹⁰⁶ Exercise results from ASCIET should not be considered absolute, but they do add insight. The exercise supports construction and utilization of a dynamic CID network and does show effective fratricide results from the interoperability. Additionally, the report made the recommendation to develop procedures and refine interoperability for real-time, direct JSTARS targeting for attack aircraft and indirect fire.¹⁰⁷

JSTARS participated again in ASCIET 99 and a quick look message has been released, but the formal evaluation report was not available for this paper.¹⁰⁸

VIII. Conclusion and Recommendation

Fratricide will always be a priority concern among the military. Few situations in combat are as devastating to morale as fratricide. The complexity of the battlespace will surely continue to increase. The military must learn to operate within this future environment with minimal risk to its own troops by its own combat power.

Air-to-ground fratricide remains one of the most difficult areas of CID. A number of different service elements merge from their respective operating environments and must execute immediate engagement decisions. Poor judgement in time constrained situations elicits devastating results. Demands for similar CID technology across multiple services are cost prohibitive and clearly not the solution. Efforts to restrict operations between air and ground elements to reduce fratricide have the inverse affect of

also reducing combat effectiveness against the enemy. Overall progress in joint CID has been slow. However, one joint system has showed a steady reduction in fratricide incidents to an acceptable culmination point: no casualties in the last major conflict involving both air and ground units.

Analysis of the joint air CID system shows that it has effectively worked for reducing air-to-air and surface-to-air fratricide among air-breathing threats. The system is still evolving to include missile threats. Analysis of the air CID system was included in this monograph for two primary reasons. The first reason was to highlight the integrated systemic approach and methodology that was used. The air CID system developed under a concept specifically seeking to integrate a network of individual joint air and ground elements that each contributed to a synergistic product, a single integrated air picture. The whole is greater than the sum of the parts: the individual elements receive the greatest benefit from the end product, maximum joint situational awareness that can range from tactical to strategic levels. Most significantly, it allows individual elements to cross-cue their own organic system information against the larger picture, facilitating decision making and effective system employment for critical factors such as target location and identification.

The second reason an analysis of the joint air CID system was offered was to examine the role of AWACS within that system. As AWACS & JSTARS are unique radar platforms, the examination of AWACS in the air system lends precedence for exploiting JSTARS capabilities within the network. The focus is not to create a parallel surface network with JSTARS as a hub, but to utilize JSTARS as a fusion piece that begins the melding process of the separate surface and air pictures into a common joint

awareness.

The surface and air environments do not exist within a vacuum. Despite which service may have the preponderance of units and be commanding efforts in a specific theater, the surface and air environments are components of the overall joint battlespace. Therefore, technologies and operational procedures developed specifically to address joint operational concerns, such as fratricide, should be developed, analyzed, and evaluated in terms of how they will integrate within that larger joint network. Ignoring this system concept could lead to numerous expensive technologies that ultimately never fully address the particular problem.

This is what has happened in the joint CID area. The Department of Defense is suffering from “technological determinism,” a mindset of throwing technology at a problem and expecting the applicable society to adapt accordingly.¹⁰⁹ As an academic concept alone this thinking is flawed, but it is particularly inadequate when applied to military society. The last decade has shown that in spite of developing numerous effective fratricide technologies, implementing them in significant numbers across the board uniformly to sufficiently affect the joint problem is not feasible.

One of the reasons for the non-feasibility is that fielded military systems in each service span a technological spectrum from legacy to state-of-the-art. Air Force ground attack shooters range from the World War II era B-52, to Vietnam era A-10's, to the stealthy, strategic range B-2. It is illogical to suggest that all air platforms incorporate the same CID technology, especially when the Army and the Marine Corps have no consensus on a common ground CID system. This situation reinforces the concept that leveraging central C4I platforms such as JSTARS is key to formulating a feasible,

suitable network of systems that produces a common joint awareness.

The current Joint Combat Identification Office discussed in Chapter Three has an organizational structure problem. It is not tasked, funded, or empowered to be an effective agency providing vision and focus for joint system CID integration and implementation. This paper recommends restructuring it, or dissolving it in lieu of standing up a new joint organization specifically tasked to incorporate systems thinking with the CID problem. The organization must be tasked to function as “network designers.” Their mission should be to identify the “system of systems” that will incorporate currently fielded technologies across the joint battlespace to the maximum extent. They should identify leverage points such as JSTARS that facilitate the formulation and dissemination of a common joint ground picture. They also should leverage off the components of the current air CID system, as the ultimate aim should be a synergistic joint common picture that spans air and ground operations. This organization should receive joint funding that is independent of a specific service or single platform. Finally, it should develop an implementation strategy and be empowered to direct the necessary elements within the military community.

A primary focus of this joint “network design” organization should specifically be to leverage existing components, not only for a return on investment for the military, but because that would be the timeliest approach to address fratricide. It is not that more new technologies are required, it is that the myriad of existing ones have not been organized into a dynamic system that produces a whole greater than the sum of the individual parts. It follows that the individual services would receive the biggest and quickest benefit from incorporating minimal new technologies and procedures that maximize their current

investments and fielded systems. It also follows that organizations that are not tasked to develop and execute implementation strategies are not effective, as is the current situation.

This paper has demonstrated how this concept might work just by analyzing how JSTARS has done this. JSTARS can fuse various diverse battlespace data into a larger joint awareness that has shown promising results for CID on a small scale. It has done this by integrating existing diverse datalinks, by identifying and creating new data message sets for individual elements tapping into the system, by developing new joint doctrine, tactics, techniques and procedures, by joint testing and training with various individual elements of the system, and by incorporating new technologies only when proven that they provide the most benefit for the greatest number of participants within the system. This last fact is essential to maximizing cost effectiveness within a budget-constrained military.

The JSTARS operational units and program office have taken the lead in leveraging this system in joint CID efforts that have been discussed in this paper. However, these units aren't funded, tasked, or empowered to take this process to the necessary level. That next level is really where the process should have initially originated: the singular joint battlespace network of systems. Other major platforms have undoubtedly also made significant process in systematic approaches to joint problems. However, a specific organization must have the singular mission of drawing the multitude of diverse individual elements of the complex joint battlespace into an effective networked system. Without this, a significant reduction in fratricide is not likely, particularly in the critical air-to-surface mission area.

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Endnotes

¹ Chairman Joint Chiefs of Staff Guide to Battle Casualty Rate Patterns for Conventional Ground Forces, (Washington, DC: Joint Staff for Logistics, 1998).

² Joint Doctrine Encyclopedia, (Washington, DC: Joint Staff for Operational Plans and Interoperability, 1997), 302. While several joint publications reference fratricide in their texts, it was conspicuously absent from the glossaries of these publications, perhaps because it is such a fundamentally understood term within the military. The Joint Doctrine Encyclopedia and Field Manual 101-5-1 were the only references in the joint series to offer formal definitions. Much of the Joint Encyclopedia's definition focused on the Close Air Support process, relative to air-to-surface fratricide, which supports this monograph's position on the criticality of this mission area relative to combat ID. See also Joint Publication 3-0, *Doctrine for Joint Operations*; and Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support*.

³ Geoffrey Regan, *Blue on Blue, A History of Friendly Fire*, (New York: Avon Books, 1995), 60-62.

⁴ MAJ Henry S. Larsen III, *Fratricide: Reducing the Friction through Technology*, (Fort Leavenworth, KS: School of Advanced Military Studies, 1994), 7. Larsen presents a table in his monograph compiled from three sources that indicates fratricide rates are increasing, and that fratricide rates between ten and twenty-four percent have occurred in the US military during 20th century conflicts. Larsen's sources are LTC Shrader's study referenced below, the Office of Technology Assessment, and a 1994 briefing from the US Army's Training and Doctrine Command.

⁵ U.S. Congress, Office of Technology Assessment, *Who Goes There: Friend or Foe?* OTA-ISC-537, (Washington, DC: Government Printing Office, 1993), iii.

⁶ Anthony H. Cordesman, *The Lessons and Non-Lessons of the Air and Missile War in Kosovo*, (Washington, DC: Center for Strategic and International Studies, 1999), 56. See also Gordon and Trainor, 469-470.

⁷ Joint Staff, Joint Publication 3-09, *Doctrine for Joint Fire Support*, (Washington, DC: Joint Staff, 12 May 1998), IV-12. For independent research studies, see LTC Charles Shrader, *Amicide: The Problem of Friendly Fire in Modern War*, (Fort Leavenworth, KS: U.S. Army Command and General Staff College, Combat Studies Institute Research Survey No. 1, 1982), 61; and Enrique E. Cruz, *Fratricide in Air-Land Operations*, (Unpublished Masters Thesis, Monterey, CA: Naval Postgraduate School, December 1996), v.

⁸ Shrader, x.

⁹ All Service Combat Identification Evaluation Team, Mission Statement (Internet <http://asciet.eglin.af.mil/home.html>, accessed 15 October, 1999).

¹⁰ *Multiservice Procedures for the Theater Air-Ground System*, FM 100-103-2, MCWP 3-25.2, NWP 3-56.2, AFTTP 3-2.17, (Langley AFB, VA: Air Land Sea Application Center, July 1998), III-15.

¹¹ Air Force Tactics, Techniques and Procedures Manual 3-1, Volume 30, *Joint Surveillance Target Attack Radar System (JSTARS) Employment*, (Washington, DC: Headquarters U.S. Air Force, 22 January 1999), 1-1. Unclassified excerpts.

¹² Field Manual 101-5-1, Marine Corps Reference Publication 5-2A, *Operational Terms and*

Graphics, (Washington, DC, Headquarters Department of the Army, United States Marine Corps, September 1997), 1-71.

¹³ Shrader, viii. Shrader felt the term fratricide had a well-known technical usage with respect to artillery, and also possessed connotations of intent and civil conflict. He created the term "amicide." Shrader developed the word from the Latin noun amicus (friend) with the Latinate suffix -cide (killing). Other authors writing about fratricide have used Shrader's term, but the term has not been adopted by the military. There are no service doctrine or joint doctrine publications that use or define amicide. This monograph adheres to the doctrinal reference above; agreeing that intent is indeed an important factor in fratricide. For these reasons, the doctrinal term "fratricide" is used throughout this monograph.

¹⁴ Office of Technology Assessment, 19. Summarized from a list of ten specific detrimental effects of fratricide in this study.

¹⁵ General H. Norman Schwarzkopf, *The Autobiography, It Doesn't Take a Hero*, (New York: Bantam Books, 1992), 581-582.

¹⁶ Schwarzkopf, 211.

¹⁷ Schwarzkopf, 211. The death of Sgt. Michael Mullen is the subject of C.D.B. Bryan's book, *Friendly Fire*. Schwarzkopf expresses concern in his book over the Mullen family and the author being able to receive all the known facts about the fratricide incident, and he states that the book is an "honest and moving account," 213.

¹⁸ Regan, 9-21.

¹⁹ Regan, 16.

²⁰ Carl Von Clausewitz, *On War*. (Edited and translated by Michael Howard and Peter Paret. Princeton, N.J: Princeton University Press, 1976), 101. The phrase "fog of war" never actually appears in *On War*, but the term has become common in military culture relative to uncertainty and chance in battle, derived from Clausewitz' concept.

²¹ Clausewitz, 113. Clausewitz' theory of friction in war is more complex, it is developed throughout Chapters 4-8 of Book One in *On War*, as these factors and their relationship are examined. Only the essence of the concept is addressed here for simplicity.

²² Clausewitz, 117. Emphasis in original.

²³ Regan, 126-127.

²⁴ Shrader, 54.

²⁵ Report of the Defense Science Board Task Force on Combat Identification, (Washington, DC, Office of the Under Secretary of Defense for Acquisition and Technology, 1996), v.

²⁶ Defense Science Board Task Force on Combat Identification, 1-2.

²⁷ Shrader, 29.

²⁸ Shrader, 54.

²⁹ Shrader, 42-43 and 122-123. Shrader notes that figures vary for casualties in Operation Cobra. He attributes Martin Blumenson's figures from *Breakout and Pursuit* to likely be most correct, due to

research done later than others with better materials.

³⁰ Martin Blumenson, *Breakout and Pursuit*, (Washington, DC: Center of Military History, U.S. Army, 1984), 228.

³¹ Regan, 165. See also Blumenson, 229-230.

³² Blumenson, 229-231. See also Regan, 164 and Shrader 42.

³³ Blumenson, 229.

³⁴ Shrader, 43. See also Blumenson, 233-236, and Regan, 166.

³⁵ Regan, 166. See also Blumenson, 236 and Shrader, 43.

³⁶ Blumenson, 236.

³⁷ Regan, 167.

³⁸ Shrader, 50.

³⁹ Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey Summary Report*, (Washington, DC: U.S. Government Printing Office, 1993), 22.

⁴⁰ Office of Technology Assessment, 27.

⁴¹ Shrader, 105.

⁴² Cruz, 58-59.

⁴³ Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War*, (Boston, MA: Houghton Mifflin Company, 1993), 464.

⁴⁴ Michael R. Gordon and General Bernard E. Trainor, *The General's War*, (New York: Little, Brown and Company, 1995) 273.

⁴⁵ Atkinson, 206-207. See also Gordon and Trainor, 273-274.

⁴⁶ Atkinson, 207.

⁴⁷ Cruz, 58.

⁴⁸ U.S. General Accounting Office, *Operation DESERT STORM: Apache Helicopter Fratricide Incident*, GAO/OSI-93-4 (Washington, DC: Government Printing Office, 1993), 30. The division commander had ordered his subordinate commanders to avoid direct participation in the fighting. The battalion commander knowingly disobeyed this order.

⁴⁹ Atkinson, 318-319.

⁵⁰ U.S. Atlantic Command, *Combat Identification Capstone Requirements Document Draft*, (Norfolk, VA: USACOM/J38, January 1999), 5. Unclassified excerpts. USACOM was renamed Joint Forces Command on 1 October, 1999. This document has not yet been published under the new command name so it is referred to by USACOM.

⁵¹ Joint Staff, Joint Publication 3-55, *Doctrine for Reconnaissance, Surveillance, and Target Acquisition Support for Joint Operations*, (Washington, DC: Joint Staff for Operational Plans and Interoperability, 14 April 1993), IV-4.

⁵² U.S. Atlantic Command, 6. Unclassified excerpts.

⁵³ Gordon and Trainor, 457.

⁵⁴ U.S. Atlantic Command, 5. Unclassified excerpts.

⁵⁵ U.S. General Accounting Office Report to Congressional Committees, *Combat Identification Systems: Changes Needed in Management Plans and Structure*, (Washington, DC: Government Printing Office, September, 1995), 1.

⁵⁶ Bill Jezierski, Captain (Select), U.S. Navy, Memorandum to Chairman, Joint Chiefs of Staff. Subject: *Combat Identification Reorganization*, (Washington, DC: Joint Staff Force Structure, Resources, and Assessment Directorate/J8, 29 August 1997).

⁵⁷ Buzz Collins, CDR, U.S. Navy, Information Paper to Chairman, Joint Chiefs of Staff, Subject: *Combat Identification*, (Washington, DC: Joint Staff/Joint Combat Identification Office, March, 1998) 1.

⁵⁸ Collins, 2.

⁵⁹ Naval Air Warfare Center, *Report on the 1998 Joint Service Combat Identification Systems Conference*, (Patuxent River, MD: Naval Air Warfare Center Aircraft Division, October 1998), Volume I and II.

⁶⁰ U.S. Atlantic Command, 11-12. Unclassified excerpts.

⁶¹ U.S. Atlantic Command, 8-9. Unclassified excerpts.

⁶² Peter M. Senge, *The Fifth Discipline*, (New York: Doubleday, 1990), 69.

⁶³ Naval Air Warfare Center, Volume II, 4.

⁶⁴ Joint Staff, Joint Requirements Oversight Council memorandum, JROCM 024-98, 9 March 1998. The surface-to-surface mission area ranked first.

⁶⁵ Waterman, Danny L, CMDR, USN, *Fratricide: Incorporating DESERT STORM Lessons Learned*, (Newport, RI: Naval War College, March 1993) 18. In the only reported surface-to-air incident during Desert Storm, a USN A-6E fighter reported being fired on by a friendly surface-to-air missile. The missile did not hit the aircraft; there was no damage. See also Office of Technology Assessment, 27.

⁶⁶ Keaney and Cohen, 60.

⁶⁷ Defense Science Board Task Force on Combat Identification, 37.

⁶⁸ It bears noting that the successes discussed in this chapter in air-to-air and surface-to-air CID are currently relative only to air-breathing threats. The theater ballistic and cruise missile threat that has emerged in the decade since Desert Storm is not effectively countered within the current joint air CID system. These missile threats are high priority due to their ability to employ weapons of mass destruction. However, the methodology in place to integrate this requirement into the existing joint air CID system is the important lesson. The Joint Theater Air Missile Defense Organization (JTAMDO) was stood up with the specific mission to analyze the threat and incorporate workable technologies and new procedures into the

existing system; utilizing and maximizing currently fielded system components. The organization does not have the latitude to develop its own new system. This lesson is important in joint CID, because as this paper identifies, developments have been stovepipes within the different mission areas and services. For more information on the mission of JTAMDO and its role in joint air CID, see the JTAMDO Charter, (Washington DC: Joint Staff Force Structure, Resources, and Assessment Directorate/J8, 15 March 1997).

⁶⁹ *Multiservice Procedures for the Theater Air-Ground System*, VII-11.

⁷⁰ Joint Staff, Joint Publication 3-01, *Joint Doctrine for Countering Air and Missile Threats*, (Washington, DC: Joint Staff for Operational Plans and Interoperability, 19 October 1999), II-7.

⁷¹ Joint Publication 3-01, *Joint Doctrine for Countering Air and Missile Threats*, III-2.

⁷² Joint Publication 3-01, *Joint Doctrine for Countering Air and Missile Threats*, V-4.

⁷³ *Multiservice Procedures for the Theater Air-Ground System*, III-14, 15.

⁷⁴ Joint Theater Air Missile Defense Organization, *White Paper on The Single Integrated Air Picture*, (Washington DC: Joint Staff Force Structure, Resources, and Assessment Directorate/J8, 19 May 1998), 3.

⁷⁵ See Global Command and Control System and Theater Battle Management Core System in *Multiservice Procedures for the Theater Air-Ground System*, III-16.

⁷⁶ The only recent incident of air-to-air fratricide occurred during Operation PROVIDE COMFORT in 1994, during which two USAF F-15 fighters shot down two USA Blackhawk helicopters resulting in 26 fatalities. PROVIDE COMFORT was not a combat operation, it was what the military now terms an "operation other than war." Intense investigation of this well-publicized incident concluded that the fratricide was not the result of a breakdown in the joint air CID system, but rather a lack of a number of individual participants to correctly adhere to operational and tactical CID procedures in place within that theater. The conclusion of the Air Force investigation determined that had these individuals acted accordingly, the incident would not have occurred. See Secretary of Defense Memorandum prepared for the Service Secretaries and Chiefs, Subject: *Aircraft Accident and Corrective Action*, Washington, DC, 12 July 1994.

⁷⁷ *Multiservice Procedures for the Theater Air-Ground System*, VII-12.

⁷⁸ Joint Publication 3-09, *Doctrine for Joint Fire Support*, IV-13.

⁷⁹ *Multiservice Procedures for the Theater Air-Ground System*, III-15.

⁸⁰ Close Air Support aircraft may be passed directly from AWACS to terminal controllers. They may also be passed to either JSTARS or ABCCC or to both systems before being passed to terminal controllers. The specific procedure for individual missions will be assigned through the applicable Air Tasking Order. For detailed procedures concerning tactical level control of joint close air support aircraft by joint command and control platforms, see Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support*; *Multiservice Procedures for the Theater Air-Ground System*, Chapter 3; Joint Publication 3-09, *Doctrine for Joint Fire Support*, Chapter 2; and Air Force Tactics, Techniques, and Procedures Manual 3-1, Volume 26, *Tactical Employment --Theater Air Control System Employment*.

For procedures concerning operational level command and control in joint air operations, see Joint Publication 3-56.1, *Command and Control for Joint Air Operations*.

⁸¹ Office of Technology Assessment, 27.

⁸² U.S. Atlantic Command, 11.

⁸³ All Service Combat Identification Evaluation Team, *ASCIET 97 Evaluation Report*, (Eglin AFB, FL, March 1998), 6. Unclassified excerpts.

⁸⁴ Regan, 11. General Norman Schwarzkopf and General Sir Peter de la Billiere agreed that orange and green colored panels, and six-foot high inverted "V" letters painted on tanks and fighting vehicles would be effective deterrents to air-to-ground fratricide, it was later determined these markings were not visible from above 5,000 feet. See Atkinson, 464.

⁸⁵ Field Manual 101-5-1, Marine Corps Reference Publication 5-2A, *Operational Terms and Graphics*, 1-67. See also Joint Publication 1-02.

⁸⁶ Gordon and Trainor, 411.

⁸⁷ Gordon and Trainor, 412.

⁸⁸ Gordon and Trainor, 412. For a detailed look at the specific doctrinal implications with the current FSCL concept, see Major Gregory Schultz's monograph, *Coordinating Operational Fires for the Twenty-First Century*, School of Advanced Military Studies Monograph, Fort Leavenworth, KS: US Army Command and General Staff College, 1998. Major Schultz discusses the doctrinal problems with the current system that are outside the scope of this paper. He examines the utility of a Joint Forces Fires Coordinator.

⁸⁹ For a more detailed analysis of the Army's BCIS, see Larsen, *Fratricide, Reducing the Friction through Technology*.

⁹⁰ Mulholland, David, *Pentagon Finds Ways to Cut Fratricide*, Army Times, November 2, 1998, 26.

⁹¹ Mulholland, 26.

⁹² Defense Science Board Task Force on Combat Identification, v.

⁹³ For specific information on the CGS, other ground station variants and their respective services, see Air Land Sea Application Center, *Multiservice Tactics, Techniques, and Procedures for the Joint Surveillance Target Attack Radar System*, FM 90-37, MCRP 2-2B, NWP 3-55.13, AFTTP (I) 3-2.2. (Langley AFB, VA: Air Land Sea Application Center), July, 1997. Unclassified excerpts. See also Air Force Tactics, Techniques and Procedures Manual 3-1, Volume 30, *JSTARS*, 1-4.

⁹⁴ This connectivity was specifically conducted in the operational joint exercises, FOAL EAGLE 97, and HUNTER WARRIOR 97. Lessons Learned from these exercise can be requested from the 93rd Air Control Wing at Robins AFB, GA. Contact the Operations Support Squadron Tactics Office (93 ACW, OSS/OST). For details concerning the operational testing of this capability, contact Detachment 2, 605th Test Squadron, Melbourne, FL (tenant unit of Patrick AFB, FL). For technical and engineering information, contact the JSTARS primary defense contractor, Northrup-Grumman Battle Management Systems Division, Melbourne, FL.

⁹⁵ *Multiservice Tactics, Techniques, and Procedures for the Joint Surveillance Target Attack Radar System*, Chapter 3. See also HUNTER WARRIOR 97 Lessons Learned from 93rd Air Control Wing.

⁹⁶ *Multiservice Tactics, Techniques, and Procedures for the Joint Surveillance Target Attack Radar System*, Unclassified Executive Summary, 2.

⁹⁷ *Multiservice Procedures for the Theater Air-Ground System*, III-16.

⁹⁸ Air Force Tactics, Techniques and Procedures Manual 3-1, Volume 30, *JSTARS*, 1-1. Unclassified excerpts.

⁹⁹ These concepts were first demonstrated in operational training scenarios during Operation JOINT ENDEAVOR in 1995 and 1996, before JSTARS had even declared operational capability. Through voice coordination between JSTARS, attack pilots, and forward air controllers (FAC), the concept provided higher confidence positive ID, improved location accuracy and faster target engagement of moving vehicles in spite of mountainous terrain and foliage. See Lessons Learned from 93rd ACW and Detachment 2, 605th Test Squadron. These concepts were further refined in exercise FOAL EAGLE 97. See Headquarters, United States Forces, Korea, Memorandum FKJ3-OP-A, Subject: *Hotwash After Action Report for Joint STARS FOAL EAGLE 97*, 20 November 1997.

¹⁰⁰ For detailed information on attack support procedures involving JSTARS, see Air Force Tactics, Techniques and Procedures Manual 3-1, Volume 30, *JSTARS*, Chapters 3-5 and appendixes, and also Joint Publication 3-09, II-3,4.

¹⁰¹ Major Joseph Rossacci, Minutes from the Combat Identification Conference, (Headquarters Air Combat Command Directorate of Operations, Langley AFB, VA: Command and Control Operations Division, 16-17 March 1999) 1-8. See also Detachment 2, 605th Test Squadron, *Concept of Operations for Joint STARS Advanced Technologies*, (Melbourne FL: Det 2, Operations, 21 July 1999). This document specifically covers JSTARS interfaces with COBRA and Unmanned Aerial Vehicles. It also provides information on integration of a kinematic automatic tracker, automatic target recognition, electronic support measures, and various radar upgrades to both JSTARS radar modes. This document outlines the block model upgrades currently programmed for the aircraft.

¹⁰² For more information on these systems and their interfaces, see ASCIET 96 and 97 Evaluation Reports. For more information on SABER and EPLRS interface, see V. Byrd, *The Integration of SABER with EPLRS*, Master's Thesis, (Monterey, CA: Naval Postgraduate School, December 1996). BCIS is unfortunately absent from the list of interfaces with JSTARS; it is the system identified in Chapter Six as the primary future Army CID system. One of the reasons for this disconnect is the lack of formal joint office oversight for the integration of CID systems, as cited in this paper in Chapter Four.

¹⁰³ For more information on ASCIET, see CAPT James R. Stone, *All Service Combat Identification Evaluation Team*, *Military Intelligence Professional Bulletin*, Volume 22 Issue 4, October-December 1996, 42. See also the ASCIET homepage at <http://asciet.eglin.af.mil/html>; Internet.

¹⁰⁴ *ASCIET 97 Evaluation Report*, 6-41. Unclassified excerpts.

¹⁰⁵ *ASCIET 97 Evaluation Report*, 6-53 through 6-54, 7-2. Unclassified excerpts.

¹⁰⁶ *ASCIET 97 Evaluation Report*, 6. Unclassified excerpts.

¹⁰⁷ *ASCIET 97 Evaluation Report*, 11. The report also recommended integrating digital situational awareness and ID capabilities, such as EPLRS, SABER, Grenadier BRAT, and ATR with JSTARS, and addressing JSTARS constraints in training, tactics, techniques, procedures, and joint exercises. Unclassified excerpts.

¹⁰⁸ All Service Combat Identification Evaluation Team, *ASCIET 99 Quick Look and Lessons Learned*. Eglin AFB, FL, April, 1999. Unclassified.

¹⁰⁹ For further information on the concept of technological determinism, see Merritt Roe Smith and

Leo Marx, eds., *Does Technology Drive History?* (Cambridge, MA: MIT Press, 1994), xi.